Available online at www.sciencedirect.com
ScienceDirect
Atmospheric Environment 41 (2007) 4773–4780
ATMOSPHERIC ENVIRONMENT
www.elsevier.com/locate/atmosenv

Review

Calculation of concentration of aerosol particles around a slot sampler

S.K. Zaripov[a,*], M.V. Vanyunina[a], A.N. Osiptsov[b], E.V. Skvortsov[a]

[a]*Institute of Mathematics and Mechanics, Kazan State University, Universitetskaya, 17, 420008 Kazan, Russia*
[b]*Institute of Mechanics, Lomonosov Moscow State University, Michurinskii pr.1, 119899 Moscow, Russia*

Received 16 September 2006; received in revised form 6 March 2007; accepted 9 March 2007

Abstract

A mathematical model and numerical procedure are proposed for investigation of aspiration efficiency and the particle concentration field around a slot sampler in a moving gas. A potential-flow model for the carrier gas and a Lagrangian method for calculation of particle trajectories and concentration are employed. The particle concentration patterns around the slot and at the sampler inlet are studied. The dependence of the aspiration efficiency on the ratio of the wind and sampling velocities is analyzed. It is shown that the local aspiration efficiency calculated on the symmetry axis of the slot gives satisfactory approximation for the integral aspiration efficiency.

Keywords: Aerosol sampling; Aspiration efficiency; Particle concentration

Contents

1. Introduction

Direct methods of aerosol measurements in atmosphere are based on aerosol sampling into different measuring devices. Aerosol probes give an opportunity to determine the particle concentration and the particle size distribution. The presence of the sampler and the action of sampling cause disturbances in the surrounding medium and affect the particle movement. It can lead to significant difference of the given fraction particle concentration in the sampler inlet and in the free stream. In the sampling theory, the notion of aspiration efficiency is introduced to characterize the deviations

*Corresponding author. Tel.: +7 843 2381705; fax: +7 8432 382209.
E-mail address: shamil.zaripov@ksu.ru (S.K. Zaripov).

1352-2310/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.atmosenv.2007.03.009